

CLAIMS

1. Catheter system for performing intramyocardiac therapeutic treatment comprising:
 - 5 - a catheter having a hollow catheter body provided on its terminal end with a needle system for the injection of fluids through said catheter;
 - the body of the catheter having at least two longitudinal lumina which are connected at one end to external means for administering fluids;
 - the needle system having at least two longitudinal lumina connected to the
10 corresponding lumina of the catheter;
 - wherein said longitudinal lumina are provided with respective lateral discharge openings.
2. Catheter system according to Claim 1, in which the terminal end needle system
15 of the catheter consists of a multilumen needle.
3. Catheter system according to Claim 1, in which the at least one of said longitudinal lumina of the needle system is obtained in a needle of helical type.
- 20 4. Catheter system according to Claim 2, in which the multilumen needle is of the helical type.
5. Catheter system according to Claim 1, in which the terminal end needle system of the catheter is formed by at least two single-lumen needles.
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6. Catheter system according to Claim 5, in which the needles which form the needle system are of different lengths.
7. Catheter system according to Claim 1, in which the discharge openings of the
30 lumina of the needle system are in different longitudinal positions of the needle itself.

10. Catheter system according to Claim 6, in which the shorter needle is provided with several lateral discharge openings.
- 5 11. Catheter system according to Claim 5, in which the needle system is formed by two helical needles of different length which are centered with respect to the axis of the catheter.
12. Catheter system according to Claim 11, in which the helical needles are
10 arranged alongside each other and fixed with welds, the tip of the shorter needle being integral with and connected to the body of the longer needle.
13. Catheter system according to Claim 12, in which the helical needles have a cross section which is flattened and such that the needle system formed by it has a
15 substantially round cross section.
14. Catheter system according to Claim 12, in which the helical needles enter into the catheter with straight sections arranged along the axis of the said catheter.
- 20 16. Catheter system according to Claim 1, in which the needle system is formed by a straight needle aligned with the axis of the catheter and by a helical needle arranged concentrically around said central needle.
17. Catheter system according to Claim 16, in which the central straight needle is
25 shorter than the helical needle.
18. Catheter system according to Claim 16, in which the central straight needle is longer than the helical needle so as to act as a centering device and rotational pivot for said helical needle.
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19. Catheter system according to Claim 16, in which the helical needle enters into

the catheter with a section located alongside the central needle.

20. Catheter system according to Claim 16, in which the helical needle enters into the catheter with a section distant from the central needle so as to prevent the rotation
5 of the catheter when this section comes into contact with the wall of the myocardium.
22. Catheter system according to claim 1, in which the needle system is electrically conducting.
- 10 23. Catheter system according to Claim 22, in which the electrically conducting needle system is lined with a thin film of electrically insulating material over nearly the whole of its length, except for a suitable tip section which remains electrically conducting.
- 15 24. Catheter system according to Claim 23, in which the electrically insulating material which partly lines the needle system comprises material known as "Parylene".
25. Catheter system according to Claim 22, in which the body of the catheter comprises a first longitudinal electrical conductor connected at one end to the needle
20 system and designed for connection at the external end to an external electrical apparatus.
26. Catheter system according to claim 1, characterized in that the body of the catheter has an internal longitudinal structure of meshwork braiding, which allows a
25 twisting torque to be applied to the external end of the catheter and to ensure that this causes a corresponding rotation of the multilumen needle system fixed onto the terminal end of said catheter.
27. Catheter system according to claim, 25 in which the body of the catheter is
30 provided with a second longitudinal electrical conductor which is electrically insulated from the conductor connected to the needle system and designed for connection of the

external end to an external electrical apparatus and for connection of its terminal end to an electrically conducting ring located on the terminal end of the catheter and having the function of a reference electrode for all the operations where the needle system performs the function of a conductor of electrical impulses.

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28. Catheter system according to claim 27, in which the said first and second electrical conductors are seated, with suitable mutual insulation, in at least one longitudinal secondary lumen in the body of the catheter.

10 29. Catheter system according to Claim 28, in which any one of the said electrical conductors may be constituted by the said twisting braiding if made of electrically conducting material.

15 30. Catheter system according to claim 25, in which the external electrical apparatus comprises a source of electric energy and electrical impulses.

31. Catheter system according to claim 25, in which the external electrical apparatus comprises an apparatus for monitoring electro-physiological signals.

20 32. Catheter system according to claim 25, in which the external electrical apparatus comprises an apparatus for measuring the electrical impedance.

25 33. Catheter system according to claim 1, in which the body of the catheter comprises at least one filament-like, longitudinally extending, flexible conductor of ultrasound energy which is acoustically coupled to the needle system and designed for connection at its external end to an external apparatus supplying ultrasounds.

30 34. Catheter system according to claim 1, in which the body of the catheter comprises on its terminal end, at the base of the needle system, a stopping device of the retractable type, with an external activating and deactivating control device, for limiting the penetration of said needle system into the myocardium.

35. Catheter system according to Claim 34, in which the stopping system comprises a torus-shaped balloon which is made of flexible and impermeable material and which, via a connection duct of its internal chamber, is connected to the terminal end of a secondary longitudinal lumen in the body of the catheter, the external end of which is designed for connection to an external system for supplying and drawing fluid into and from said balloon, respectively so as to fill it and activate it for the end-of-travel function which it must perform, or so as to neutralize it and ensure that it remains in the retracted condition, which is useful during insertion and extraction of the catheter.

36. Catheter system according to claim 35, in which the main lumina in the body of the catheter are intended to convey the tracer fluid, have the form of a circle segment and are arranged opposite each other in specular fashion, these lumina having, arranged between them in a symmetrical manner, a first axial secondary lumen for receiving the spindle guiding the catheter during use and there being provided, laterally with respect to this lumen, on the one hand a second secondary lumen for conveying the fluid filling and emptying the end-of-travel balloon (13) and, on the other hand, a third secondary lumen for receiving the electrical conductors, the ends of which are connected to the needle system and to the annular reference electrode.

37. Catheter system according to claim 36, in which the lumina of the catheter, except for the first axial lumen, are closed at the external front end and the front section of the said catheter having, mounted on it without the possibility of axial displacement, a rotating distributor or header provided around the said catheter with annular chambers which are isolated from each other and with respect to the exterior by annular sealing gaskets and into which chambers there lead, via respective radial holes, the two main lumina which are connected to the base connecting sections of the needle system and the secondary lumen leading to the end-of-travel balloon, these chambers being provided with respective hollow connectors for connection to flexible pipes and to syringes containing respectively the fluid for filling and emptying said balloon, the tracer fluid and the therapeutic fluid.

38. Catheter system according to Claim 37, in which the distributor or header is made of electrically insulating material and is provided with electrical conductors having brushes which allow an external electrical apparatus to be connected to the electrical
5 conductors which are connected to the needle system and to the annular reference electrode, the said brushes making contact with electrically conducting rings which are fixed onto the body of the catheter, arranged at a suitable distance from each other and insulated and fixed to the terminals of the said electrical conductors which emerge from the associated guide lumen through lateral holes.

10 39. Catheter system according to Claim 5, characterized in that, an ultrasound generator is mounted on the terminal end of the catheter, said ultrasound generator being integral with the base of one or both the needles of the needle system and connected to an electrical circuit which passes through a secondary lumen of the
15 catheter for connection to external power supply systems.

40. Catheter system according to claim 1, in which the body of the catheter has, an external diameter of about 7 French, that is about 2.1 mm.

20 41. Catheter system according to claim 1, in which the diameter of the helix of the needle system with at least one helical needle is about 2 mm.

42. Catheter system according to claim 6, in which the length of the projecting section of the longer needle of the needle system does not exceed, 5 mm, while the
25 length of the projecting section of the shorter needle is about 2.5 mm.

43. Catheter system according to claim 5, in which the external diameter of each of the needles which form the needle system is about 0.30 mm.